Multifunction/Multimode Digital Avionics

Breakout Session C

20August, 2003

Comments Regarding ICNS May 2003 Outbrief on SDR

- Technical challenges need to be elaborated (e.g., bandwidth, dynamic range, radio functionality, end-user applications)
- RTCA SC 200 should be consulted for possible involvement in MMDA.
- Relevant AEEC subcommitte(s) should be consulted for possible involvement in MMDA.
- Backward compatibility with existing waveforms should be easy to accomplish due to their simplicity relative to recent and emerging waveforms.
- Business case is uncertain for an open platform standard vs. allowing proprietary solutions to evolve.

Revised Problem Statement

- In addition to current problem statements….
  - Multiple national standards
  - Expensive to certify and upgrade/recertify
  - Lack of reconfigurability
- The group defined additional issues that are at the core of the motivation for the MMDA….

Revised Problem Statement

- The accelerating pace of new waveform development, and the difficulty of retiring legacy waveforms, is beginning to overwhelm the ability of aircraft manufacturers and operators to fit aircraft with new capabilities.
- Need a new, cost-effective methodology to certify avionics – both for initial product certification and for subsequent certifications when new waveform functions are added to an existing product.

Recommendations

- Focus on multi-mode communications as a starting point for multi-function avionics (e.g., communications for C, N, and S).
- Build on existing JTRS multi-mode standards and architecture (leverage JTRS developed waveforms and algorithms), but don't plan to mandate.
- Standards should be detailed enough to fully specify requirements to ensure interoperability without stifling manufacturer innovation.
- Infosec should be a prime consideration in developing a MMDA architecture
- Consider defining broad collections of functional capabilities that can be rolled into specific MMDA equipment classes. (e.g. Rx-only vs. Tx/Rx, Simultaneous vs. Sequential modes, etc..)
- First phase (FY04-FY05) work should concentrate on necessary "homework" to validate the need to invest in research, standards development, and prototype development.
  - We can't yet say whether an investment in a flyable MMDA prototype (that is useful to industry) is justified based on what we know now.
  - Define reassessment points and go-forward criteria early on.
- Coordinate with relevant RTCA and AEEC activities (e.g., SC-200) for possible interest in new standards work.

Other Discussion Points

- Investment required for software certification may negate the original advantage of creating a SDR.
- Evolutionary Roadmap
  - - Use SDR to facilitate movement towards RTSP
  - - For overall MMDA architecture, include secure onboard networking and routing capabilities
- Consider parallel effort to explore supporting antenna technology.
- A program to develop and fully evaluate a multi-mode prototype in an operational environment could cost as much as $20M.
- Consider fostering the development of core technologies useful to any MMDA manufacturer. (e.g., current high-resolution A/D Converters provide 14 bits @ 100MHz; Goal=20 bits @ 100MHz)

Integration Team Questions

- It's 2009, the NExTNAS-CNS MMDA Sub-Project has spent its budget and has delivered key transitions/enabling breakthroughs toward an ATM transformation because it has successfully:
  - Fostered development of a cost effective certification process
  - Demonstrated a prototype that is of value to the industry
  - Transferred relevant technology to industry
- It's 2009, the NExTNAS-CNS Project has spent its budget and has delivered key transitions/enabling breakthroughs toward an ATM transformation because it has successfully:
  - Preserved spectrum and optimized its use
  - Enabled cost-effective MMDA products capable of utilizing optimized spectrum
  - Fostered the migration toward a Global A/G Network

Participant List

- Frank Mackowick (Johns Hopkins University / Applied Physics Lab)
- James Budinger (NASA GRC)
- Richard Barhydt (NASA LaRC)
- Mike Bristow (iFly Air Taxi)
- Chuck LaBerge (Honeywell)
- Rajesh Raghavan (Analex)
- Michael Kocin (ViaSAT)
- Roger Herron (Lockheed Martin)
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Other Discussion Points (contd.)

- Current avionics are interoperable with “some” CNS modes
- Different countries have different standards
- Should there be multiple radios ?
- Industry is looking at building a multimode radio
- Standard needs to be consistent w.r.t qualification
- Need for a balance between software and hardware in SDR
- Backup strategy needs to be robust
- Potential technology for NASA to investigate – Hi Resolution A/D Converter (~ 14bit SOA @ 100MHz; Goal=20bit @ 100MHz)
- Introduction of new waveforms frequently

Term Definitions

- Multimode
  - – Different modes for C, N & S. (e.g. VOR or GPS for Navigation)
  - - Sequential or Simultaneous
- Multifunction
  - – Classify into functions (C, N & S)

- - Are we talking about a radio that can operate in only one mode at a time (from a library) or one that can operate with multiple modes simultaneously?
- - Standards should be detailed enough to fully specify requirements to ensure interoperability without stifling manufacturer innovation.
- - We must define unambiguously the terms….SDR, multi-mode, multi-function, ….
- - We should consider defining broad collections of functional capabilities that can be rolled into specific MMDA equipment classes.
- - We need to use fy04 to do our homework. We can't yet say whether a $20m investment in a flyable MMDA prototype (that is useful to industry) is justified based on what we know now. …… Define exit ramps now.